North South University
Department of Electrical & Computer Engineering
LAB REPORT-

Course Code: CSE231L

Course Title: Digital Logic Design

Section: 09

Lab Number: 01

Experiment Name:

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Submitted by Group Number: 02

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1. Experiment Name : Digital Logic Gates and Boolean Functions

2. Objects : One of the major goals of this lab is to Familiarize the students with the proper equipment and techniques and become familliarized with combinational logic circuits.

- To study the basic logic gates such as AND, OR, NOT, NAND, NOR, and X-OR.
- To get acquainted with the description of boolean functions using truth tables, logic digrams and Boolean Algebra.

3. Apparatus : IC 7404 Hex Inverter (NOT gates), IC 7432 Quadruple 2-input OR gate, IC 7486 Quadruple 2-input XOR gates, Trainr Board, IC 7400 Quadruple 2-input NAND gate

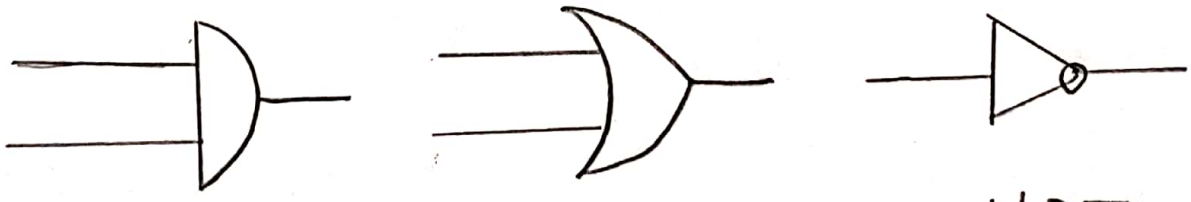
4. Theory : We know logic gates are the elementary building blocks of digital circuits. By performing one or more logical inputs, it produces a single output Digital logic gates operate at two discrete voltage levels representings the binary values 0 (Logical Low) and 1 (Logical High). Now the true and false statements, off state will be considered False and On State

will be considered true.

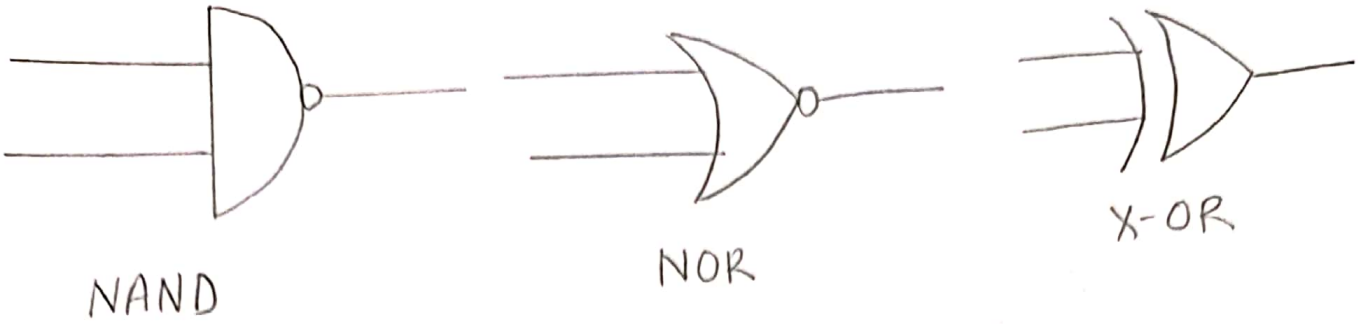
0 → Off → F → 0 V

1 → On → T → 5 V

Experiment-1 : Our first experiment was to check and verify the fundamental logic gates and also Universal gate like NAND gate, NOR gate and a special gate X-OR gate. To verify their truth table we use a traine board. In this board we took connection from the power house and one is 0 voltage which also implies off state and another was 5 V which implies as On state. We also connect the IC to the trainer board and for input we took two wire and connect them with two switch. For our output section, to check whether we get our expected output or not. We took one wire connecto the IC according to the logic gate and another end connect to the output LED section.



AND OR NOT



A	B	F=A·B	F=A+B	F=(AB)'	F=A⊕B	F=(A+B)'
0	0	0	0	1	0	1
0	1	0	1	1	1	0
1	0	0	1	1	1	0
1	1	1	1	0	0	0

A	F=A'
0	1
1	0

Table: Truth table of logic gates

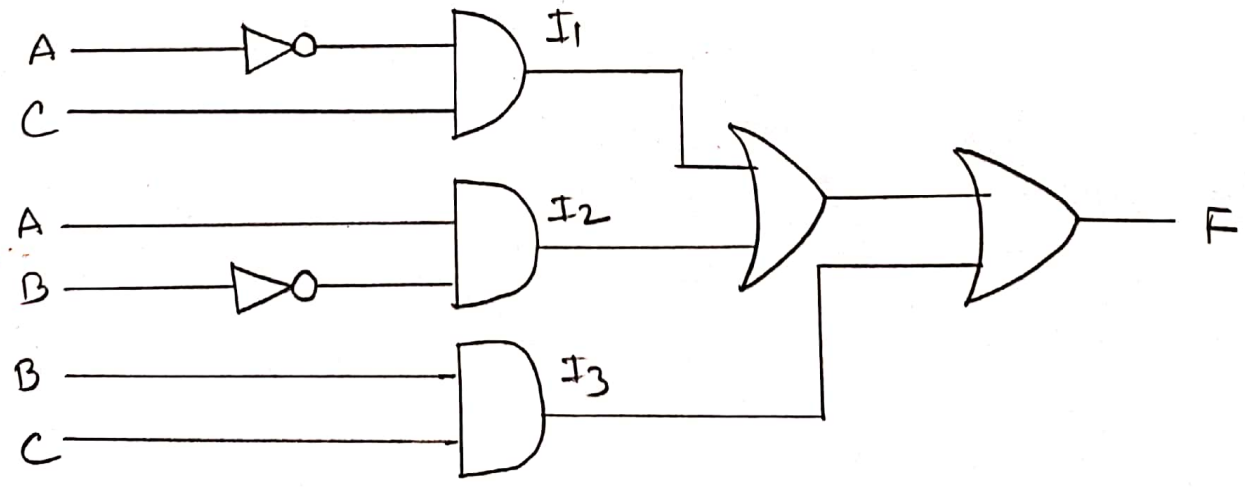
Experiment 02: In this second experiment we tried 3 input AND gate and 3 input OR gate. As we know in the truth table of AND gate, if one input is 0 then the output will also be 0. so, to show output 1, the three-input must be 1. Again In the OR gate truth table, we know that if ~~only~~ any one input is 1, then the final output will also be 1 and in OR gate when all the three input is 0, only then the final output will show zero. But to perform we need to two ~~an~~ AND gate because our IC has two input gate. For that First we put IC 7408 to the traine board and we IC pin 14 will be connected to the Vcc(+5V)

and IC pin 7 will be connected to GND. We connected two wires as input on 1, 2. Then we connected this 2 wires with some switch 14, 13 and for ~~out~~ second gate we took the output wire from 3 and connect 4 and pin 5 we connect ~~wire~~ switch 12. Thus our 3 input AND gate is complete. For final output we took pin 6 and a wire connected to a random LED. We did the same this for OR gate because the configaration for IC 7408 and IC 7432 is same.

A	B	C	F=ABC	F=A+B+C
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	0	1
1	0	0	0	1
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

3-input AND and OR

Experiment 3: In this third experiment we were given a digram, a truth table of boolean expression. So, to prove that, we could find that we need one IC 7408 AND gate, one IC 7432 OR gate and one IC 7404 NOT gate. In this experiment we have to use three logic AND gate, two Logic OR gate and also two logic NOT gate. First of all, I_1, we took one input A and connect with NOT IC pin 1, and another input e directly connected to I_1 (AND Gate). For I_2, we took A and another input B. we connect it IC 7404 pin 3 and output pin 4 connect to I_2 gate. Now IC 7408 pin 3 and pin 6 output wire, we connect it to IC 7432 pin 1 and 2. for I_3 we took input B and C and connet it to the other side of IC 7408 gate pin 10 and 9. Now IC7432 pin 3 and IC 7408 pin 8 are conneted to IC 7432 pin 4 and 5 and thus for the final output ow we took pin 6 and connect to a random LED.



Experimental Data Table :

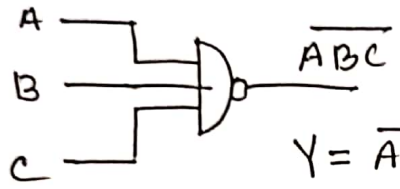
A B C	$I_1 = A'C$	$I_2 = AB'$	$I_3 = BC$	$F = I_1 + I_2 + I_3$
0 0 0	0	0	0	0
0 0 1	1	0	0	1
0 1 0	0	0	0	0
0 1 1	1	0	1	1
1 0 0	0	1	0	1
1 0 1	0	1	0	1
1 1 0	0	0	0	0
1 1 1	0	0	1	1

Question : 1

Is it possible to make a 3-input NAND or NOR gate with 2-input NAND or NOR gate?

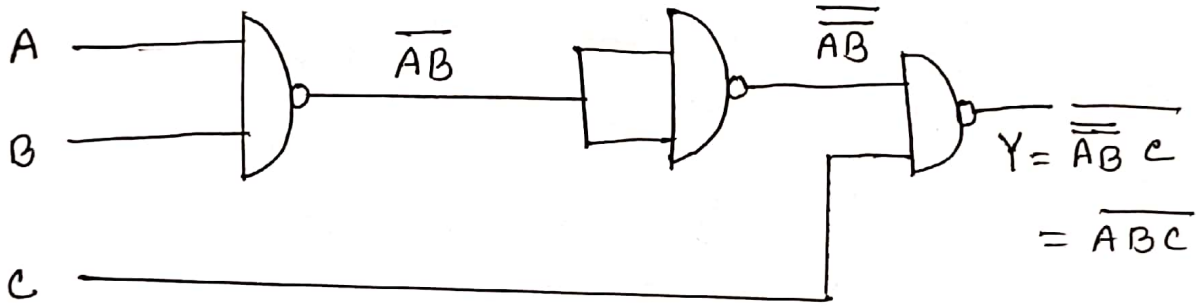
Yes, it is possible. We can justify the answere using boolean logic expression and circuit diagram.

3-input NAND Gate:

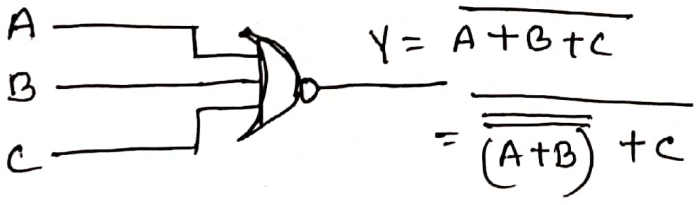


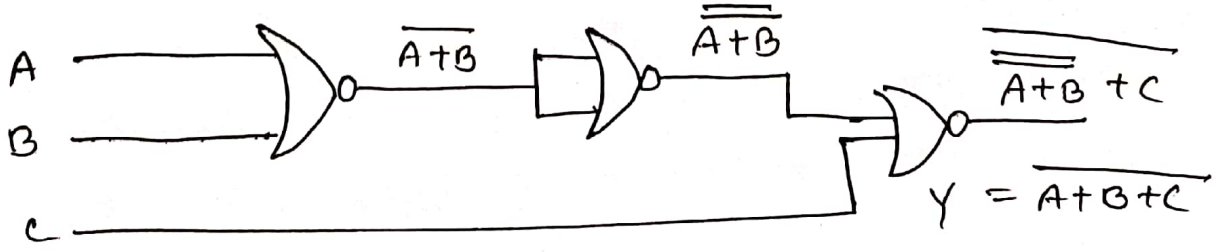
$Y = \overline{ABC}$

$= \overline{\overline{\overline{AB}} \cdot C}$



3-input NOR Gate:





Discussion: In this whole lab-01, we were introduced to fundamental logic gates, their propertise, truth table and how to work with IC. Every IC has their own configaration to work with. IC 7400, IC 7408, IC 7432 and, IC 7486 are same with their configuration. But IC 7404 which is Logic NOT gate has a little bit different. The NOR logic gate which is IC 7402 has a configuration with pin 1 output and pin 2, 3 input, similarly 4 output and 5, 6 input. Experiment 1 we prove funadamental logic circuit and their truth table. Experiment 2, we were shown 3 input AND and OR gate, finally in the experiment 3, we build a circuit using three different IC and our lab instructor told us to complete this circuit. To build this circuit we tried several time but failed because of the IC. Despite of changing several IC's of NOT gate, we still coundn't find the good IC. Finally we informed our lab instrustor and then giave us a IC that could totally work. Then we were able to finish the final task.